Unmanned Operation

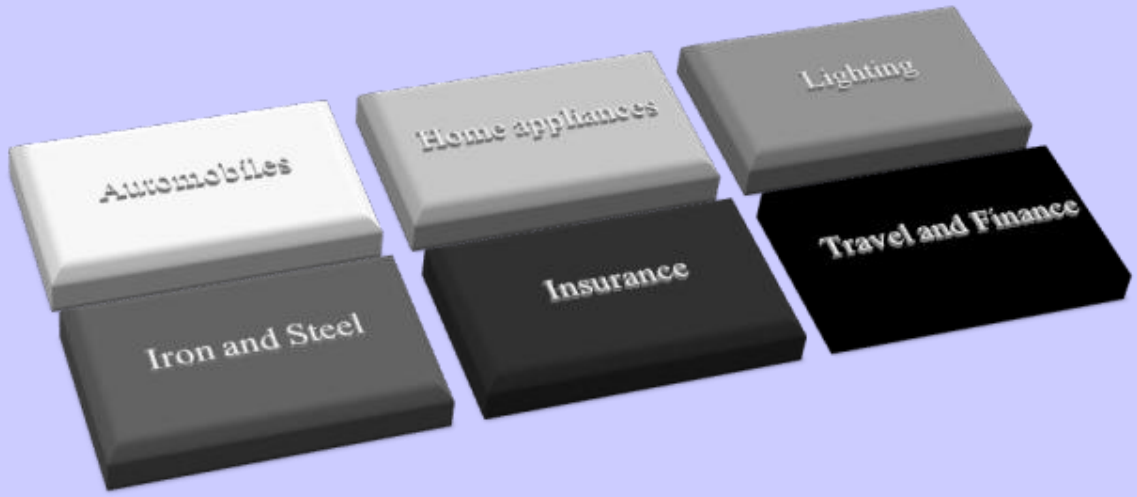
Presented By :

Bajaj Auto Ltd.

The Bajaj Group

The Bajaj group was founded in 1926 by the great visionary, Shri. Jamnalalji Bajaj.

The Bajaj group spans over a large number of industries -



OUR GUIDING LIGHTS…

Our Brand Values

Innovation … is how we create the future

Speed … is how we set the new standards

Perfection … is how we convey clear conviction

Bajaj Auto Ltd

Products

2 Wheelers

Motorcycles All 4 Stroke

Models
- Pulsar 150
- Pulsar 180
- Pulsar 220
- Discover 150
- Discover DTS-Si
- Avenger200
- Ninja 250
- Platina - 100 & 125
- CT 100 / Boxer S

3 Wheelers

Passenger Carriers

Technology
- 2 Stroke
- 4 Stroke

Fuel used
- Petrol
- Diesel
- CNG
- LPG

Goods Carriers

Technology
- 4 Stroke

Fuel used
- Diesel
- CNG
- LPG

Product Profile – Motorcycle Business

Pulsar 180 DTSi

Pulsar 220 DTSi

Pulsar 150 DTSi

Sports

Ninja 250R

Pulsar 135 LS

Avenger 220 DTSi

Product Profile – Motorcycle Business

Discover 100cc

Platina 100cc

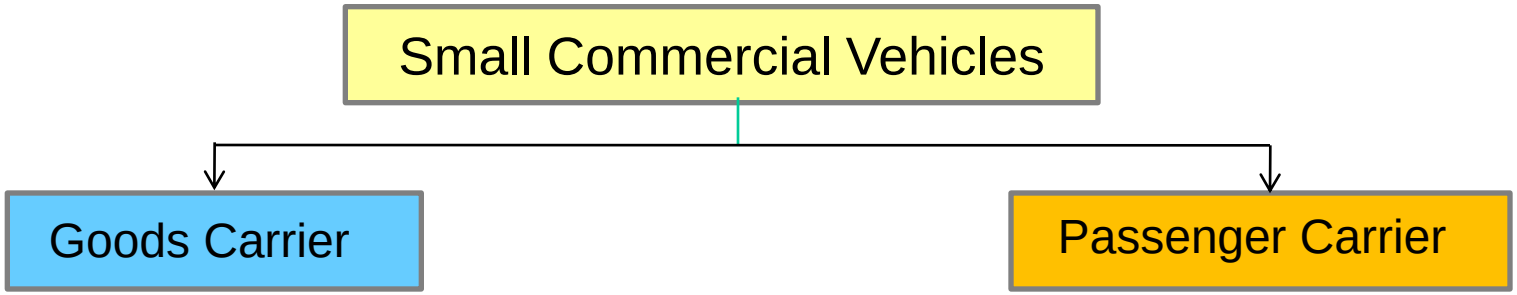
Commuter Deluxe

Discover 150cc

Commuter Standard

Platina 125cc

Small Commercial Vehicles - Segments



Product Profile - Small Commercial Vehicle Business








Goods Carrier: RE 600 – Diesel, CNG

Passenger Carrier: RE 445 Diesel; Mega Diesel; RE 145(2S)- Petrol, CNG, LPG;

RE 205(4S)- Petrol, CNG,LPG

Overall Scenario
– Unmanned Operation

History

Stone Age Era – Physical Labor

Development of Hand Tools – Physical Effort Reduced

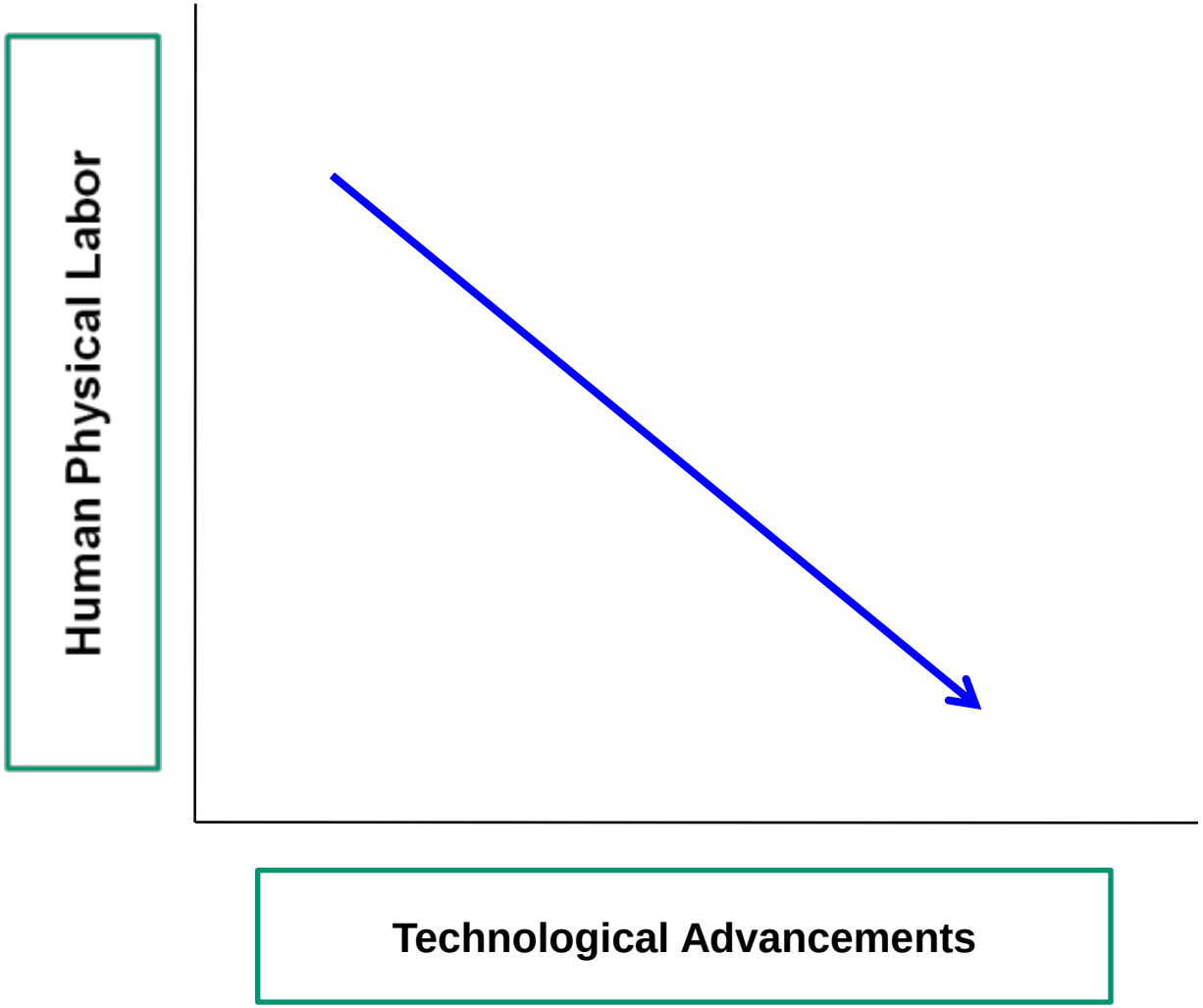
Discovery of Mechanical Means – Physical Burden reduced

1st Industrial Era : Machinery – Complex Mechanical Advancements

2nd Industrial Era : Electronics & Computer Technological Advancements

Robotics, Automations & Man less Operations

Unmanned Operation



Unmanned Operation

What all is Unmanned :

- Operations
- Complete Factory
- Products

Revolution - Products with Unmanned Operations :

- Vending Machines
- ATMs
- Space Shuttles
- Pilotless Drones

Application Area -

- Industry
- Banking
- Agriculture
- Domestic Usage
- Military
- Space Programmes
- Explorations

Scope in Industry -

- Manufacturing
- Assembly
- Packing
- Material Handling

At Bajaj …

The Need

- Yutori
- Quality
- Speed
- Flexibility

The Need

Yutori

Unmanned Operation

Yutori is a concept to create an extraordinary work culture - Joy and Pleasure at workplace

By Objectively Eliminating the 4D conditions

- Danger
- Difficult
- Dirt
- Distance

Unmanned Operation

Example – Rivet & Leak Test Machine

Loctite application by hand Danger to Fingers

Example – Washing Machine

Difficult to handle Hot Component & Fumes

Example – Sealant Application

Liquid Sealant Application – Dirty work

Unmanned Operation

Example – Crankshaft Machining

Long Distance between Machines

The Need

Quality

Quality & Man

- Skilled Activity –
  - Lack of required skills

- Monotonous & Repetitive -
  - Poka possibility
    (Forgot to do)

- Manual –
  - Tendency to accommodate non-conforming inputs
    (Forced Completion of work)

Unmanned Operation

Example – Decal Pasting

Highly Skilled Job – Rework & rejection not affordable

Decal Pasting Robot

Unmanned Operation

Example – Cylinder Head 5 Bolt Tightening

Repetitive & Monotonous – Possibility of Poka

Unmanned Operation

Example – Frame & Child Parts Welding

Forced Completion of Work

The Need

Speed

Productivity

- Production per Hour Increase
  - To cater higher demand

- Output per Man Increase
  - To remain Cost competent

Unmanned Operation

Example – Assembly Automation

Increase in Production per Hour

CONVENTIONAL BEARING PRESSES V/S ASSEMBLY AUTOMATION

Parameter	Conventional Presses	Sub-Assembly Automation
Child Parts Feeding	Total Manual Activity	Part stacker & Auto feeder arrangement
Parent Part Handling	Manual & Multiple handling	Conveyorised

ADVANTAGES

Parameter	Conventional Presses	Sub-Assembly Automation
Productivity (Output / man)	500	2000
Multi-Model Flexibility	No Flexibility. Dedicated presses.	Flexible
Set-up change time	30 minutes	5 minutes max.

Unmanned Operation

Example – Press Shop

Increase in Output per Man

The Need

Flexibility

Flexibility

- Product – Volume Mix – Multi-model Manufacturing
  - Scheduling
  - Inventory Management

By agile manufacturing – System ready for Production Dynamism

Unmanned Operation

Example – AGV

Quick Response to Change

Unmanned Operation

Example – Power & Free

Quick Response to Change

Unmanned Operation

Example – Kit Bin Transfer

Ease of Model Change

Automations through TPM small Group Activities

Inputs from JH PM,QM, SHE, KK Pillar activities

Suggestions from circle members on various topics – P,Q,C and work place improvements

Management support for implementation

- Ideas & implementation by cell members
- Ideas by cell members Implementation by managers
- ➢ In house development of Low Cost Automations
- ➢ Other improvements

- Scope for cell members creativity
- Sense of accomplishment.
- Improved moral.

Cell members appreciation through Kaizen appreciation function

After Unmanned What ? …

Sustenance is Important

Unmanned Operation

Sustenance through TPM

Unmanned operation by Technology Weaving / Integration

- Computers
- Controllers & Microprocessors
- Sensors & feedback devices
- Intelligent Instruments
- CNC Machines
- Robots
- FMS
- AGV
- Pick & Place
- Karakuri
- Low Cost Automations

Challenges

- Minor stoppages elimination
- Error proofing
- Real time feed back and correction

Through TPM

- Identification of abnormalities and corrective actions
- Cleaning, Lubrication, Inspection, Tightening as per standards.
- Maintenance Standards
- Time Based Maintenance for natural wear parts
- Condition Based Maintenance for high cost items.
- Training to cell member .
- Small group activities working on themes to eliminate minor stoppages.
- QM matrix for Error proofing.
- Generation of MP for improvement in new equipment at design stage.

Thank You…

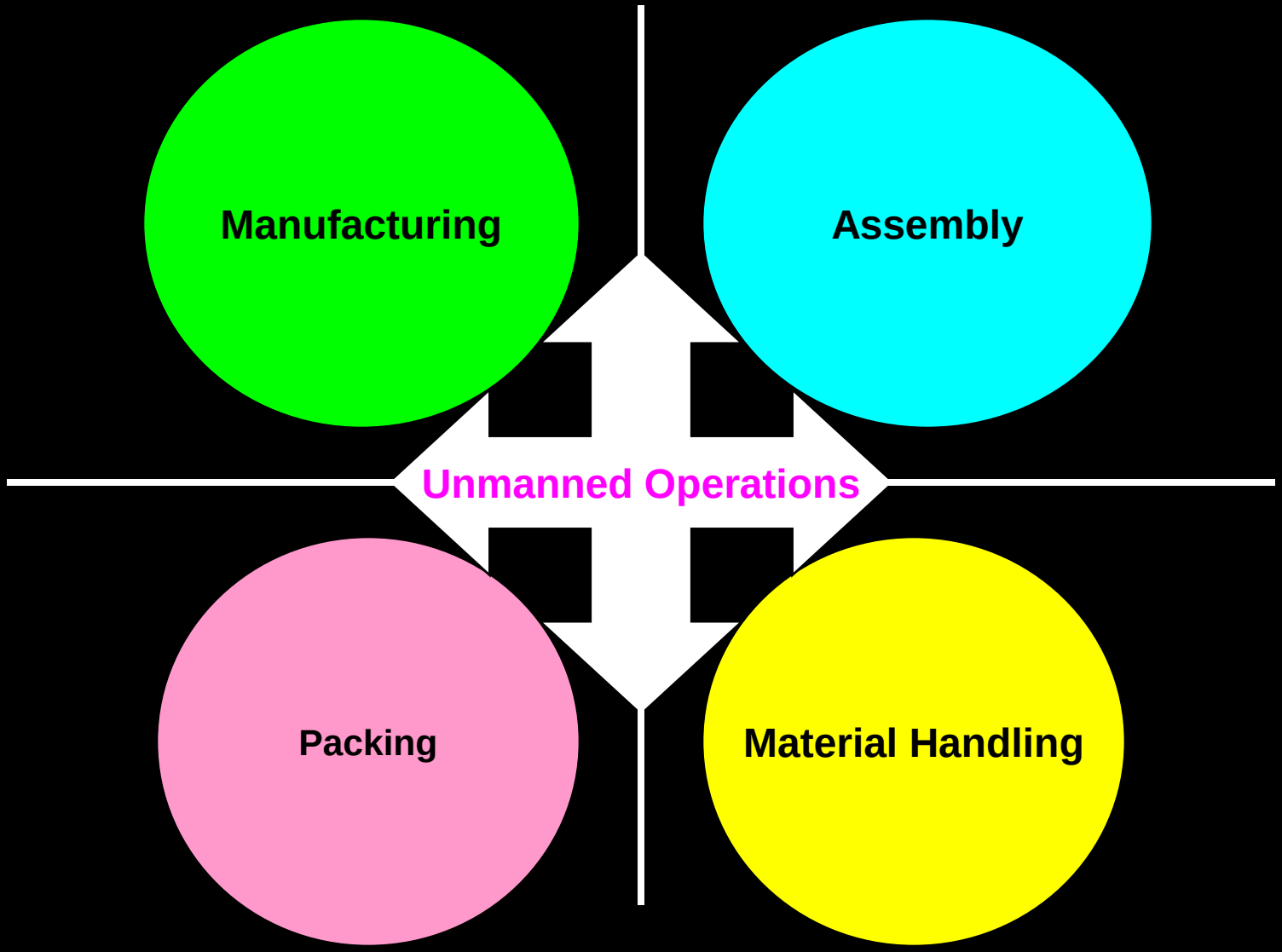
The Need

- Humans do not prefer to do certain tasks
  - Repetitive tasks – Monotonous
  - Dangerous / Hazardous tasks – Risk to Health / Life

- Humans unable to perform certain tasks
  - Due to size limitations – Heavy & Voluminous
  - Extreme environment – Outer Space or Deep Sea
  - Physically inaccessible – Health care

Unmanned Operation

Unmanned Operations In -



Manufacturing at Bajaj

- Machining – Manufacturing of Crankshaft & Crankcase
- Paint Shop – Fuel Tank Painting & Decal application
- Press Shop – Automated Pressing and component progressive transfer
- Fabrication Shop – Robotic Frame Welding & Seam Welding of Fuel tank
- Gear Manufacturing – Auto Rolling & Grouping

JH & PM Story

Assembly at Bajaj

- Engine Assembly – Offline Automations of Sub-Assemblies
  -- On line Synchronized Tightening Automations

- Vehicle Assembly – Karakuri for Vehicle Clamp & Un-clamp on Conveyor

Packing at Bajaj

- CKD Packing – On line Packing Automations
  - -- Main Box Strapping Automations
  - -- Engine Box Strapping Automations
  - -- Engine Box Pusher on line

Material Handling at Bajaj

- AGV
- Power & Free Conveyor
- Kit Bin Transfer

Thank You

for

Your Kind Attention

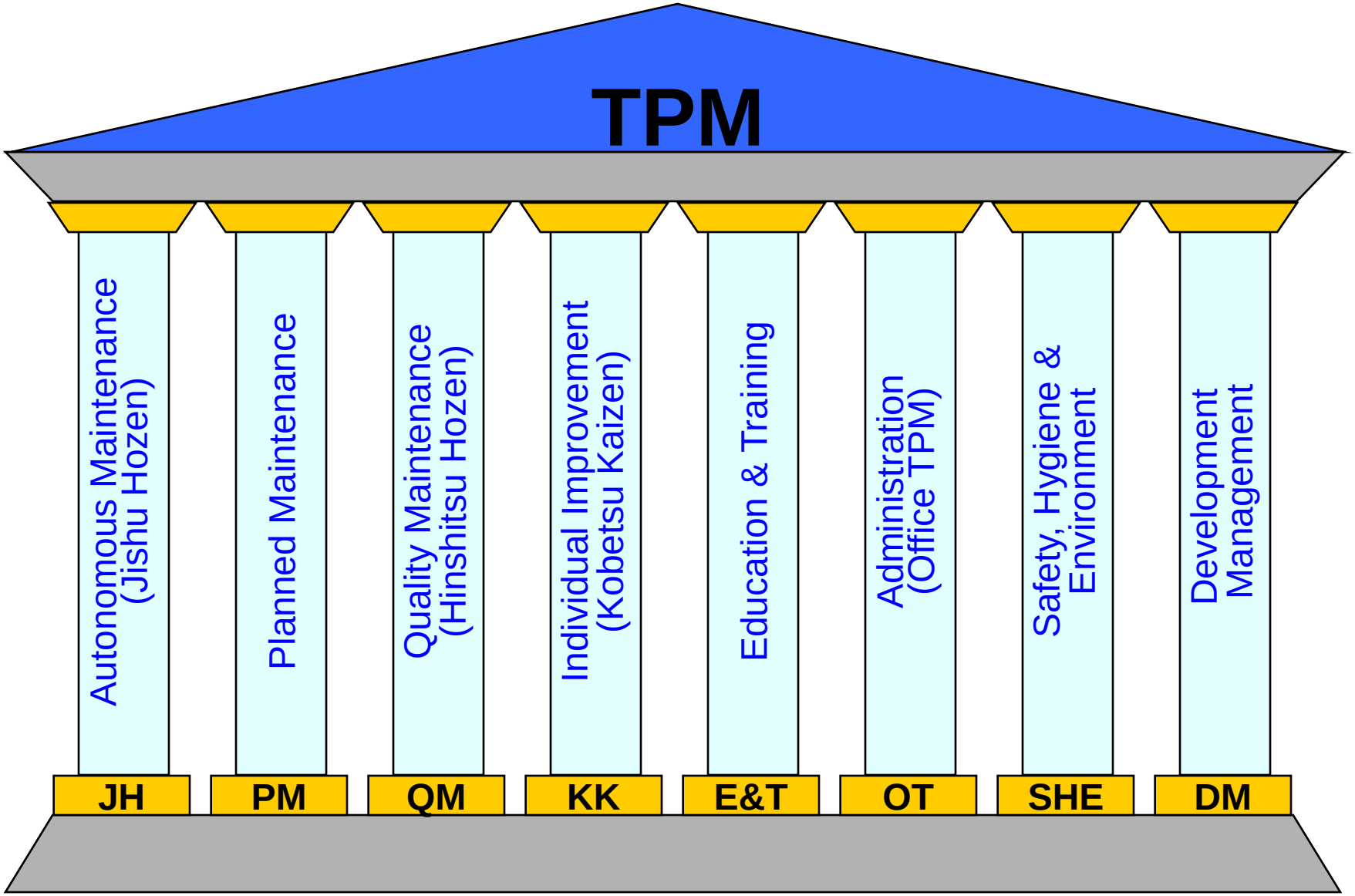
Unmanned Operation

Yutori is a concept to create an extraordinary work culture.

This is achieved by making Joy and Pleasure at workplace.

This includes creation of excellent workshop environment and enhanced standards of working practices.

Unmanned Operation



TPM Pillars for Meeting Product Quality

Pillar	Theme	Activities
JH	Autonomous Management (I Operate – I Maintain concept)	• Follow JH 7 Step Approach • Make machines User friendly • Regular Maintenance by Cell member
PM	Zero Equipment Failure – Achieve & Sustain	• Time Based Maintenance • Condition Based Maintenance • Use of Diagnostic Tools
QM	Zero defect – Achieve & Sustain (I do – I Check)	• Systematic Analysis of physical phenomena defect phenomena root cause • Defect Possibility Analysis • Pokayoke / Kaizen for Prevention of defect • 4M & T condition monitoring (QM Matrix) • Inspection Standard / Manual

Way ahead…

Technology Weaving

Unmanned Operation requires Weaving of various Technologies :

- Computers
- Controllers & Microprocessors
- Sensors & feedback devices
- Intelligent Instruments
- CNC Machines
- Robots
- FMS
- AGV
- Pick & Place
- Karakuri
- Low Cost Automations

Key : Real-time Feedback & Self-correction

Challenges - Leveraging the opportunities

- The Right “Change specialist” business model.
- New, better & affordable Technology for Products & Processes.
- Create Platform for collaborative interface.
- Demonstrating speed to address customer voice.
- Model for Customer interaction during product conception.

Unmanned Operation

Our approach for “Small Group Activity”

- Selection of theme based on loss analysis
- Area wise ownership
- Cause analysis
- Generate the kaizen ideas
- Get the In-puts from respective sub-committee
- Implement the Kaizen
- Evaluate the result
- Management presentation

Unmanned Operation

Out-come of Small Group Activity …

- Pride of achievement
- Working Enthusiasm
- Team Spirit
- Improved moral

Resulting in cohesive / team working

Unmanned Operation

Sustenance

TPM Systems

People

Training

Motivation

Achievement

Journey

Future Outlook

Appreciation of Cells Performing Autonomous Management

Yamaguchisan appreciating cell members practicing Autonomous management

Appreciation with the Family

Contents

TPM Circle – Small Group Activity

• Preparation of 4D Matrix

Sr no	Operation	4D Condition				Condition description	Counter measure to be taken
		Dirty	Damage	Difficult	Danger		
1	Adhesive spray application	Y			Y	Adhesive spray particles falling on bin	
2	Engine No. punching		Y		Y	1.Cr. Case get damage due improperly locating.	1.Proper locating pins provided on fixture. 2.Seat check Senser provided 3.Safety guard provided
2	Check engine no & sticker no complete & tick marking by marker	Y				Marker ink falling on floor & machine	1.Stand provided to marker
3	C/case LH bearings pressing & Oiling	Y	Y		Y	1.Oil trips after Drum change hole oiling 2.Cr. Case get damage if not lacated properly 3.Cr case get damage if bearing falls down before pressing. 4.Possibility of finger trapping in cr.case & ram/ locater	1.Oil collection arrangement provided 2.Proper locating pins provided. 3.Magnetic bearing holding arrangement provided to avoid cr. Case damage due to bearing falling while pressibg 4.Guide provided for breather fitting holding tool to avoid damage. 5.Safety gaurd provided

Technology Weaving

Unmanned Operation requires Weaving / Integration of various Technologies :

- Computers
- Controllers & Microprocessors
- Sensors & feedback devices
- Intelligent Instruments
- CNC Machines
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Key : Realtime Feedback & Self-correction

Unmanned Operation

P Q C S D

Daily Issues

Daily issues discussed in TPM circle meetings by cell members

Cell members brain storming & Idea generation for automations

Review & support from Management

Fabrication, Logic development & trials at kaizen work shop

Actual installation on site & monitoring results